

ORTHOGONAL REVIEW RECORD

The Reaction Cell of the Sulfur Pair: Co-synthesis on a Single Chrysene Unit, a Disulfide Bridge, and Two Forced Asymmetries

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Declaration of interest

This report is not independent. The reviewing system drafted the manuscript under review, in dialogue with the author: the section files, the verification scripts and the argument of Section 8 are its own output. A review by the drafter is a re-reading, not a second opinion, and it inherits every blind spot of the drafting. It is offered on one ground only. A re-reading conducted against the finished text, rather than forward from the idea, catches a different class of error, as the manuscript's own Appendix D records of its development. Three findings below are of that class, and two of them overturn statements the manuscript makes. This report does not discharge external review. Findings C1 and C2 in particular require a chemist who has not been party to the construction. There is no author-reply section.

Scope of Review

Every numbered statement was re-read against its cited verification block. Three independent checks were then run: a σ -transport of Article 57's Table 3 rows (R1); a rigid-geometry test of ring closure at the bridge (R2); and a classification of the verification blocks by whether they compute or merely format (R3). Severities: [MAJOR] a statement is wrong or unsupported and must change; [MINOR] a statement is defensible but overstated or misplaced; [NOTE] no change required.

Compiled disposition

Major revision. The mathematical core is sound and the principal argument is, in the reviewer's judgement, repairable. Three things must change before the paper can stand: withdraw Corollary 6.7, Proposition 6.8 and Appendix C item (10), and rewrite the offending verification block; state the dearomatisation the bridge requires and settle whether Theorem 8.11 applies to the distorted intermediate; add the no-migration premise, or close the gap it names. Two further items should be addressed and are not blocking. Two items should be claimed rather than repaired.

Required before print

Blocking. Withdraw Corollary 6.7. The verification block V17c compared against a hand-entered list of four edges and omitted C4b–C10b. Transporting Article 57's Table 3 rows by σ gives exactly the cell's six cuts. None is absent. Proposition 6.8 and Appendix C (10) fall with it. State that stage II requires pyramidalisation of at least one of the two carbons before or as the bridge closes. The carbons at C5 and C10b are sp^2 . The two sulfurs are 4.78 Å apart against 2.05 Å for the bond, a shortfall of 2.73 Å. The 1,2-dithiolane analogy does not transfer. Add the premise that no sulfur migrates between sites after bridging, with its own falsifier, or show that migration is unavailable. Without it the competing pairing is not excluded.

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1 Mathematics

M1 — [NOTE] The finite results check out

The graph-theoretic core is sound. $|\text{Aut}(X)| = 2$ is an exhaustive search and is correct. The orbit structure, the edge trichotomy, the strip's σ -invariance, the two remnant components and the pairing enumeration all re-derive. Theorem 8.11 is valid as stated.

With σ the point inversion $x \mapsto 2z - x$, one has $S(\sigma v) = 2z - S(v)$, hence $\|S(v) - S(\sigma v)\| = 2\|S(v) - z\|$, and the cross term $2\ell n(v) \cdot (v - z)$ is positive. The algebra is right and the conclusion follows.

M2 — [MAJOR] Corollary 6.7 is wrong, and its verification block tested the wrong object

The manuscript asserts that the cell destroys six skeletal edges, that five appear in the corpus's residue cut lists, and that C4b–C10b does not, being recorded there as an insertion rather than a cut. Article 57's Table 3 lists, for the second sulfur residue, five severances, the last among them C4b–C10b. Transporting these by σ and taking the union with the amended first residue's two cuts gives exactly the cell's six. None is absent from the published lists.

The block V17c reported otherwise because the list it compared against was entered by hand with four members, C4b–C10b omitted. The manuscript's own Appendix D warns of precisely this: a check that agrees with a claim because it is testing the wrong object. Corollary 6.7 must be withdrawn. Proposition 6.8, the amended completeness check, loses its motivating case and should be withdrawn with it or restated as a precaution rather than a repair. Appendix C item (10) must be withdrawn. The block must be rewritten to read Article 57's rows and transport them, not to compare against a hand-entered list. Theorem 6.6 survives. The trichotomy of fates is a statement about the cell and does not depend on how the corpus recorded them.

M3 — [MINOR] Appendix A understates its own case

Appendix A lists the sites, terminal at C5 and internal in C4b–C10b, among what is new, on the ground that the corpus's series records no heteroatom insertions. Article 57's Table 3 severs C4b–C10b in the second residue's own row. A chain $C_\beta - C_\gamma - S - C_\epsilon$ on a retained set of three vertices with that edge severed can place its sulfur nowhere else. The internal site is therefore σ -transported from the corpus and is not new. This strengthens the provenance and should be claimed. Item (3) of Appendix A should be narrowed to the terminal site.

M4 — [MINOR] Theorem 8.11's robustness is understated

The manuscript reports the bound as 3.70 Å against 2.05 Å, and the figure 3.70 comes from the rigid model via $\|v - z\| = 1.85$ Å. The theorem does not need the model. What it needs is $2\|v - z\| > 2.05$ Å, that is $\|v - z\| > 1.02$ Å, roughly two thirds of one bond length from the inversion centre, which no peripheral vertex of a four-ring aromatic can fail. State the condition in that form and the theorem ceases to depend on the model at all.

M5 — [MAJOR] The exclusion assumes the sulfurs are bridged at their final sites

Definition 8.5 places the bridge on the sulfur sites, and Theorem 8.11 then excludes the competing pairing. Nothing forbids a disulfide from binding at one pair of vertices and a sulfur migrating to its final site afterwards. If migration is available, the competing pairing is not excluded, and the selection, the manuscript’s principal result, fails. Non-implication 8.1(i) guards the weaker point, that independent delivery is not excluded. It does not guard this one. Required: either add the premise that no sulfur migrates between sites after bridging, with its own falsifier, or show that migration is unavailable. This is a gap in the argument as it stands.

M6 — [MINOR] “Exhaustive” is exhaustive over a hand-listed candidate set

Theorem 5.4 is described as exhaustive over site types. The enumeration in V16p runs over four hand-entered candidate structures, not over all structures the vessel admits. The result is almost certainly right, but the word exhaustive should either be earned by generating the candidates from the graph or replaced by “over the candidates of Appendix A.”

2 Concordance

The word “cell” is correctly handled. Article 57 declines the word for a cluster or a vessel. Article 56’s title carries the chrysene–adenosine reaction cell. Remark 2.3 adopts the latter and disclaims the former. Correct, and the precedent should be cited there rather than only asserted. The restatement of the exogenous proposition is sound and improves the corpus. Indexing exogeneity by species is right, and the observation that a pairing argument requires exactly two demands, so that six nitrogen demands could not be placed at mutually complementary slots, is a genuine strengthening of Article 57’s motivation, not a patch. Article 57’s uniqueness theorem is unaffected.

The scarcity premise is now comparative and this should reach Article 57’s own register. Appendix C item (6) records that the corpus’s medium hypothesis needs sulfur scarcer than nitrogen. That is a narrowing of a published statement and should appear in Article 57’s falsification register, not only here.

The base point is left in an unstable position. Article 57’s Definition 7.6 requires the base point in every retained set. The amended second residue has none. Appendix C item (4) offers two repairs and adopts neither, and Open problem 4.15 asks whether the base point is recoverable. A reader of both papers is left with a definition that the second paper’s central object violates. Adopt one repair in the text.

3 Chemistry

C1 — [MAJOR] The bridge cannot close on the intact aromatic frame, and the manuscript does not say so

This is the report’s principal objection. At C5 and C10b the carbon is sp^2 and its exocyclic

bond direction is fixed by the ring. There is no rotational freedom about it. Placing a sulfur at 1.78 Å along each fixed direction puts the two sulfurs 4.78 Å apart, against 2.05 Å for the bond that must join them, a shortfall of 2.73 Å, the two directions differing by 120°.

The manuscript reports the 4.78 figure at V16k and sets it aside with the remark that the point is the ring size, not the number, on the analogy of a 1,2-dithiolane whose C–S bonds rotate toward one another. That analogy does not transfer. In lipoic acid the ring carbons are sp^3 and free to rotate. Here they are aromatic and are not. The shortfall is not a rotational artefact. It follows that stage II requires pyramidalisation of at least one of the two carbons, dearomatisation of ring *C* at minimum, before or as the bridge closes. The manuscript’s stage list does not contain such a step, its ledger admits no such move, and its energy scope forbids estimating what the step costs. Required: state the dearomatisation, admit the move with its scope, and place it in the precedence relation of Theorem 9.4. The move count then rises again, and Scholium 9.13 must record it.

A consequence for Section 8. Theorem 8.11 holds for a conformation in which the inversion is realised. If the bridge forms on a pyramidalised, no longer centrosymmetric intermediate, the theorem’s hypothesis does not hold of the species at which the bridge forms, and the exclusion of the competing pairing does not follow. The manuscript must either show that the distortion preserves the inversion, which it would if both sites pyramidalise together, and the competing pairing’s sites are σ -related so they would, or restrict the theorem to the symmetric conformation and argue separately that the competing pairing cannot reach a distorted one either. The reviewer judges this repairable, and possibly by a short argument. It is not repairable by silence.

C2 — [MAJOR] Sulfur displacing an aryl–aryl bond is not an ordinary transformation

Stage III has the second sulfur displace the C4b–C10b bond to give a thioether. That bond is the central bond of a fused aromatic system. Insertion of a heteroatom into an aryl–aryl bond is not a routine operation, and the manuscript treats it as one move among several without comment. This is the largest chemical liability in the paper and it is not discussed anywhere, including in the falsification register. It should be named as the step on which chemical plausibility turns, and a precedent sought, or its absence recorded.

C3. The electron balance is global. The mechanism is local. Section 7 shows the carbon frame can supply the two electrons the disulfide sink demands. It does not show how those electrons reach the S–S bond from two benzylic carbons at the far ends of the skeleton. A global balance is a necessary condition and the manuscript is careful to claim no more, but a reader will supply the stronger reading, and a sentence should forbid it.

C4. Aromaticity is nowhere accounted. Rings *B* and *C* are destroyed and rings *A* and *D* retained. The oxidation bookkeeping covers the electrons. Nothing covers the loss of two aromatic rings, which is the dominant energetic term in the whole transformation. The scope of Remark 2.4 excludes computing it. It does not excuse omitting to mention it.

C5. The remnant prediction is good. That redox self-sufficiency forces one benzylic remnant to the aldehyde level and one to the alcohol level is the manuscript’s most testable claim, and it is testable by a single product analysis. It should be promoted in the abstract, where it currently appears only as “two otherwise equivalent remnant components must differ.”

4 Meta

X1 — [MAJOR] A third of the verification blocks format rather than compute

Remark 2.5 states that every quantitative claim is emitted by a script and that no figure is taken from notes. Of the thirty-two blocks, twenty-one derive their output from the graph or the geometric model. Eleven perform arithmetic over tables entered by hand in the script itself. The oxidation states of Section 7, the stage precedence of Section 9 and the stage assignment of each edge are of the second kind. The script formats an assertion and prints it in the same typeface as a computation. Finding M2 is what happens when the distinction is invisible.

Required. Mark each block in Appendix B’s index as computed or tabulated, and amend Remark 2.5 to say that a tabulated block is checkable but not self-checking.

The concession structure works. The manuscript states in Section 5 that it adopts the more expensive pairing, repeats it in the non-implications, and repeats it again in the conclusion. This is the right handling and it should not be softened in revision. The same holds for Section 10’s refusal to report the favourable separation without the undetermined angle.

The premise count is now four, not three. Table 2.7 lists three premises. Appendix A makes co-synthesis a fourth and the table was amended to show it. With M5 and C1 the count rises further, to a no-migration premise and a dearomatisation step. The register should be re-counted after revision, and Section 11’s conclusion re-read against it. The claim that a single unestablished hypothesis carries the principal result is no longer accurate once no-migration is added.

Two asymmetries, one of which may be an artefact. Open problem 9.11 asks whether the bridge-site choice fixes the remnant parameter. Before that is pursued, the remnant parameter should be re-derived once C1’s dearomatisation step is admitted. A step that changes the oxidation level of ring carbons will change $\nu(k)$, and the uniqueness of $k = 1$ may not survive it.

Recommendation

Major revision. The mathematical core is sound and the principal argument is repairable. Three things must change before the paper can stand.

1. Withdraw Corollary 6.7, Proposition 6.8 and Appendix C (10), and rewrite the offending verification block to transport Article 57’s rows rather than compare against a hand-entered list.
2. State the dearomatisation the bridge requires, admit it to the ledger and the precedence relation, and settle whether Theorem 8.11 applies to the distorted intermediate.
3. Add the no-migration premise, or close the gap it names.

Two further items should be addressed and are not blocking: the aryl–aryl insertion of C2 named as the chemical crux, and the computed/tabulated distinction of X1 carried into Appendix B. Two items should be claimed rather than repaired: the internal site’s provenance (M3) and the model-independence of Theorem 8.11 (M4). Both make the paper stronger at no cost.

Register of what was not checked

No energy, barrier or relaxed geometry was computed. The report inherits the manuscript’s scope. No literature value was verified. The three unfilled bibliography entries remain unfilled, and findings C1 and C2 are stated against general structural chemistry rather than against a source. No check was made of Article 57’s own internal consistency beyond the rows transported at R1. As declared at the head, the reviewing system is the drafting system. The findings above are a re-reading and not a second opinion.

References

- [Art57] C. D. Schaper. The origins transition. *Annals of the Chrysene Formalism* 1(2):1076–1106, 2026. Source of Table 3, whose rows the offending verification block should have transported rather than compared against a hand-entered list.
- [Art56] C. D. Schaper. The conditional refinement, part II. *Annals of the Chrysene Formalism* 1(2):1048–1075, 2026. Precedent for the word “cell” adopted at Remark 2.3.

Revision history

Version	Date	Notes
v1.0	2026-10-11	Review record published with Article 58.

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